SCHOOL OF MEDICINE
Department of Psychiatry
UNIVERSITY OF COLORADO **ANSCHUTZ MEDICAL CAMPUS**

AI in the Department of Psychiatry: Innovations, Efforts, and Lessons

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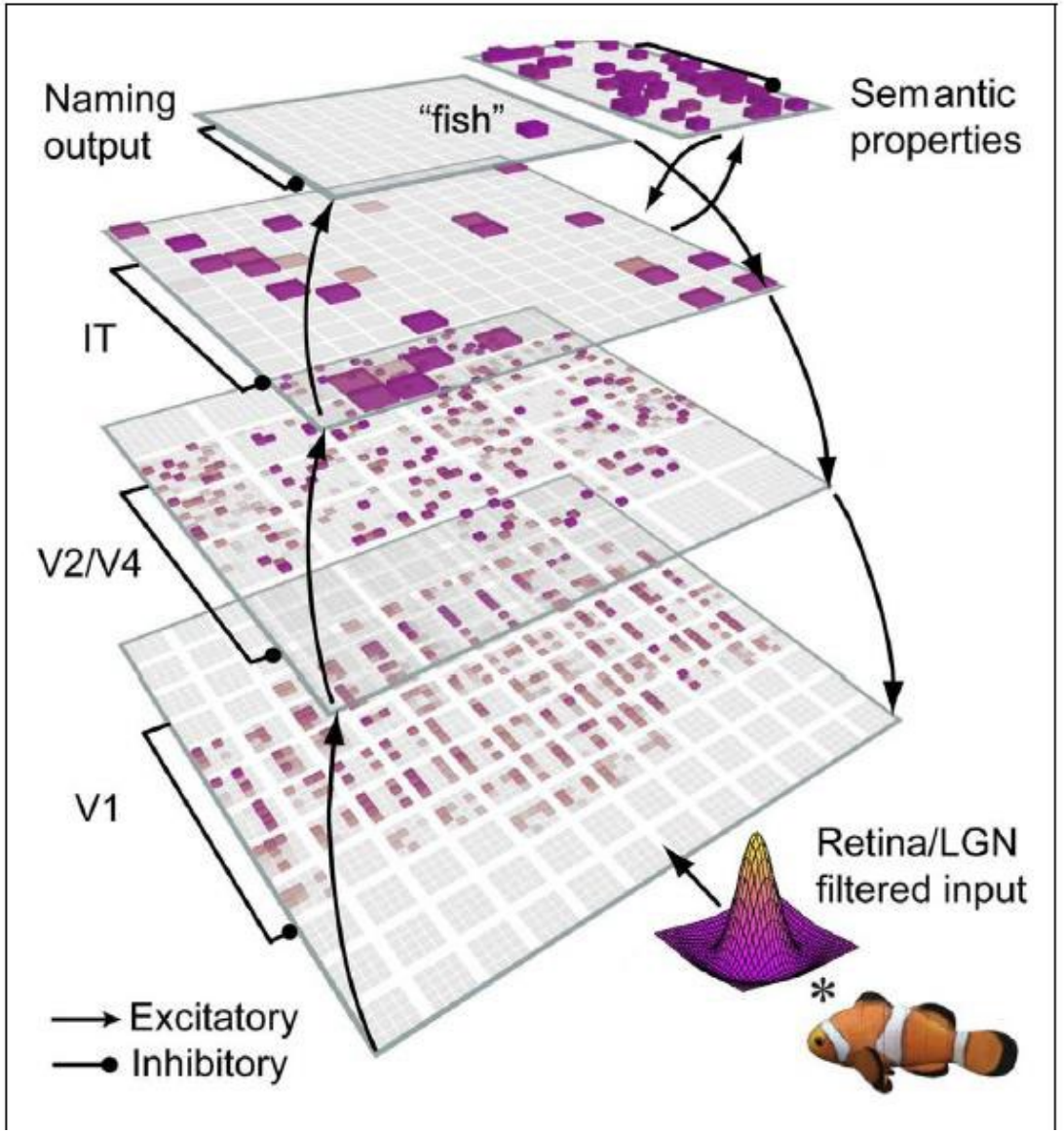
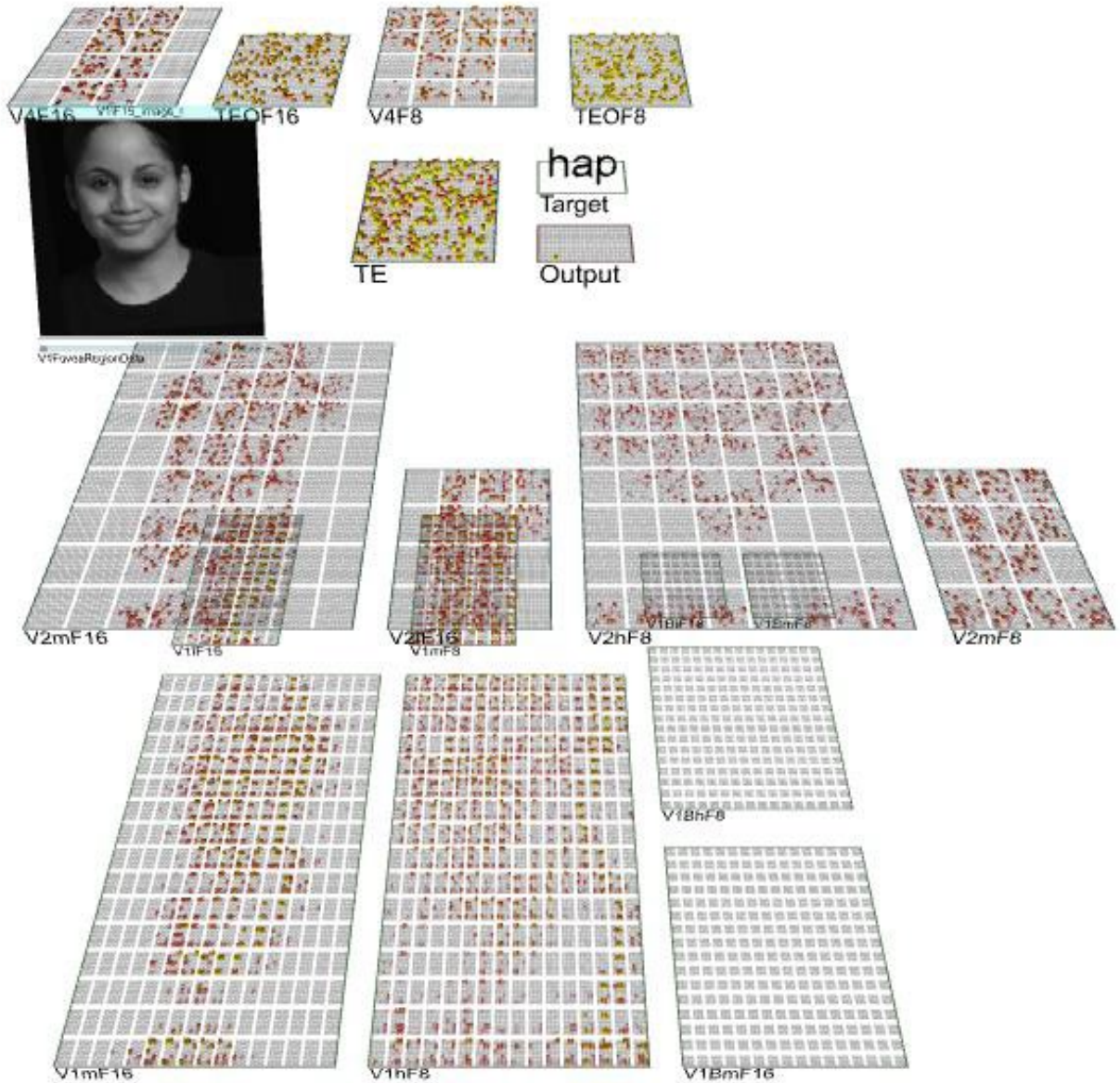
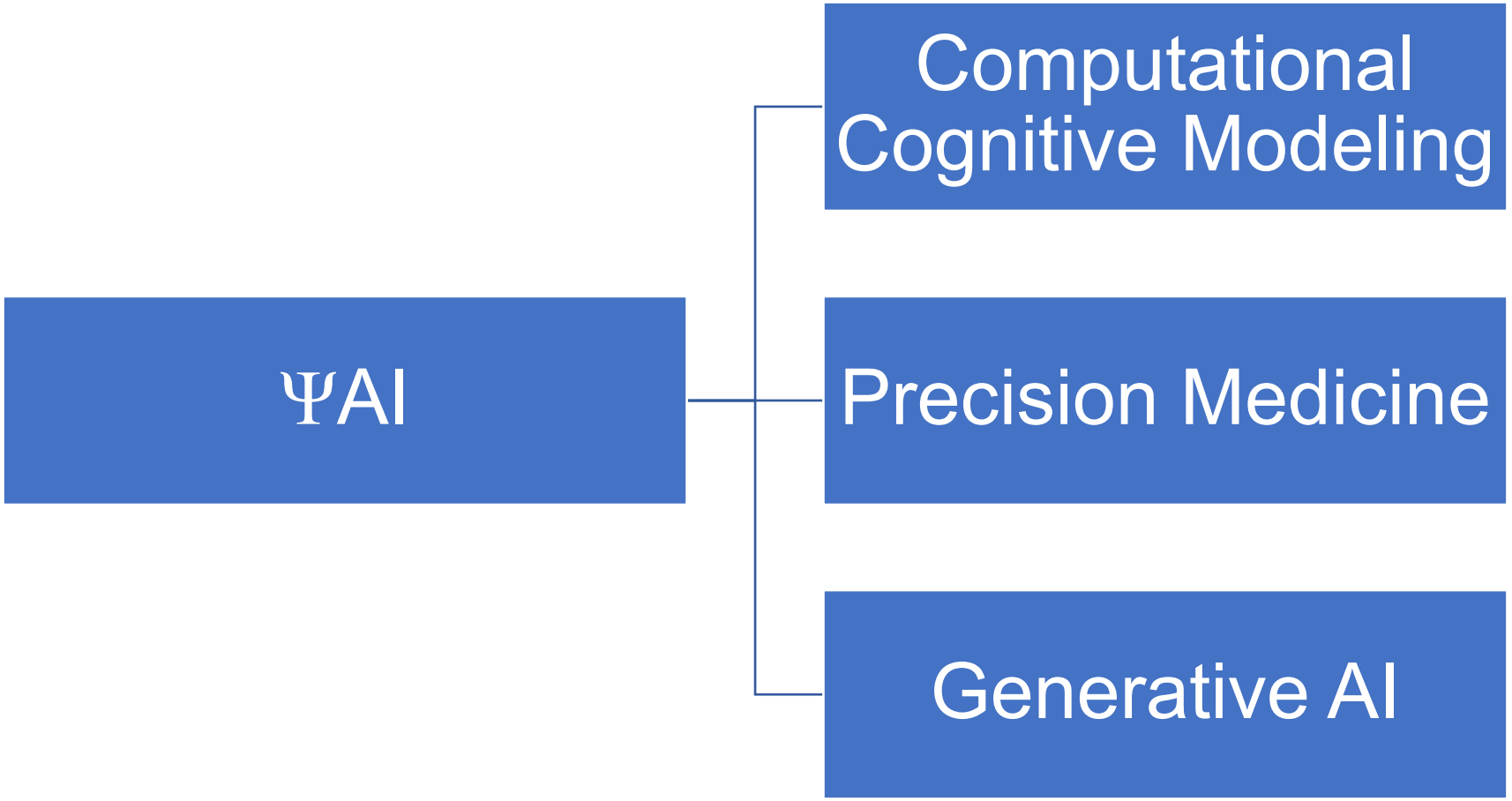
AI – Computers and Cognition





Stoddard et al., 2018

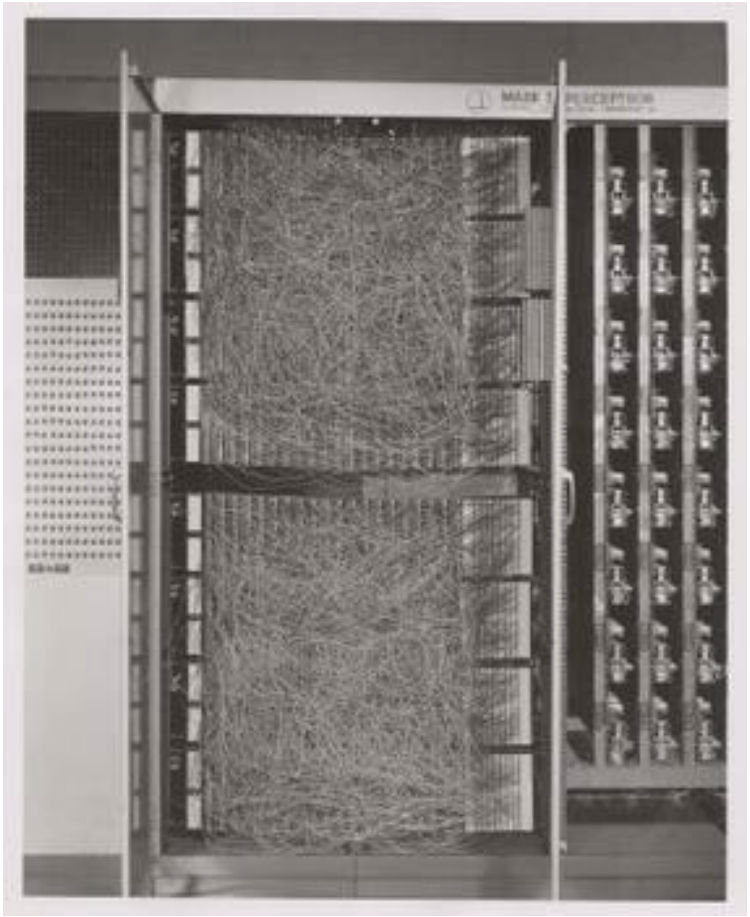


Stoddard & Jones, 2019

ΨAI

Computational Cognitive Modeling

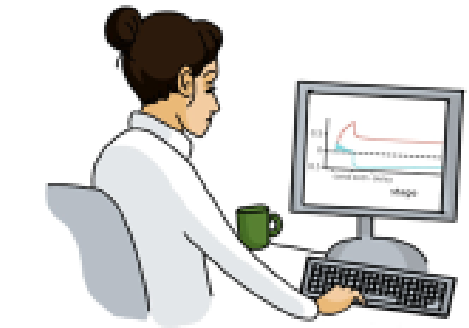
- Simulates or replicates neural function or cognitive processes
- Can teach us about function and processes
- Can be translated to measure these processes



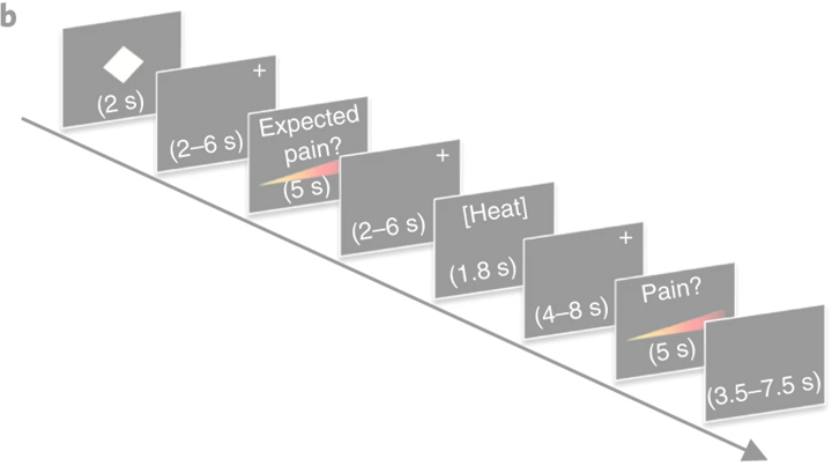
Perceptron, Source: Wikipedia

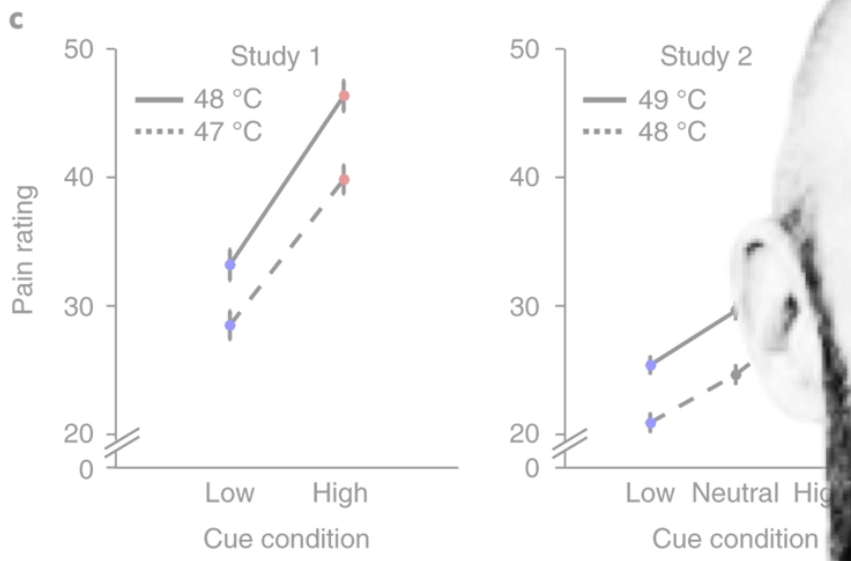
McCulloh & Pitts, 1943

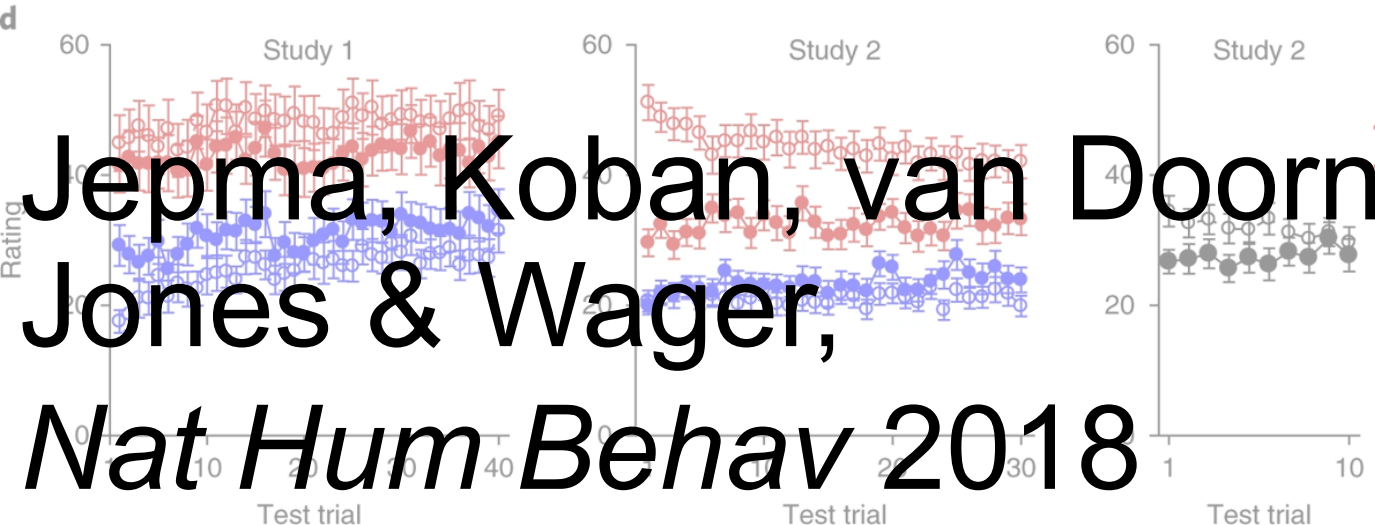
Rosenblatt, 1958



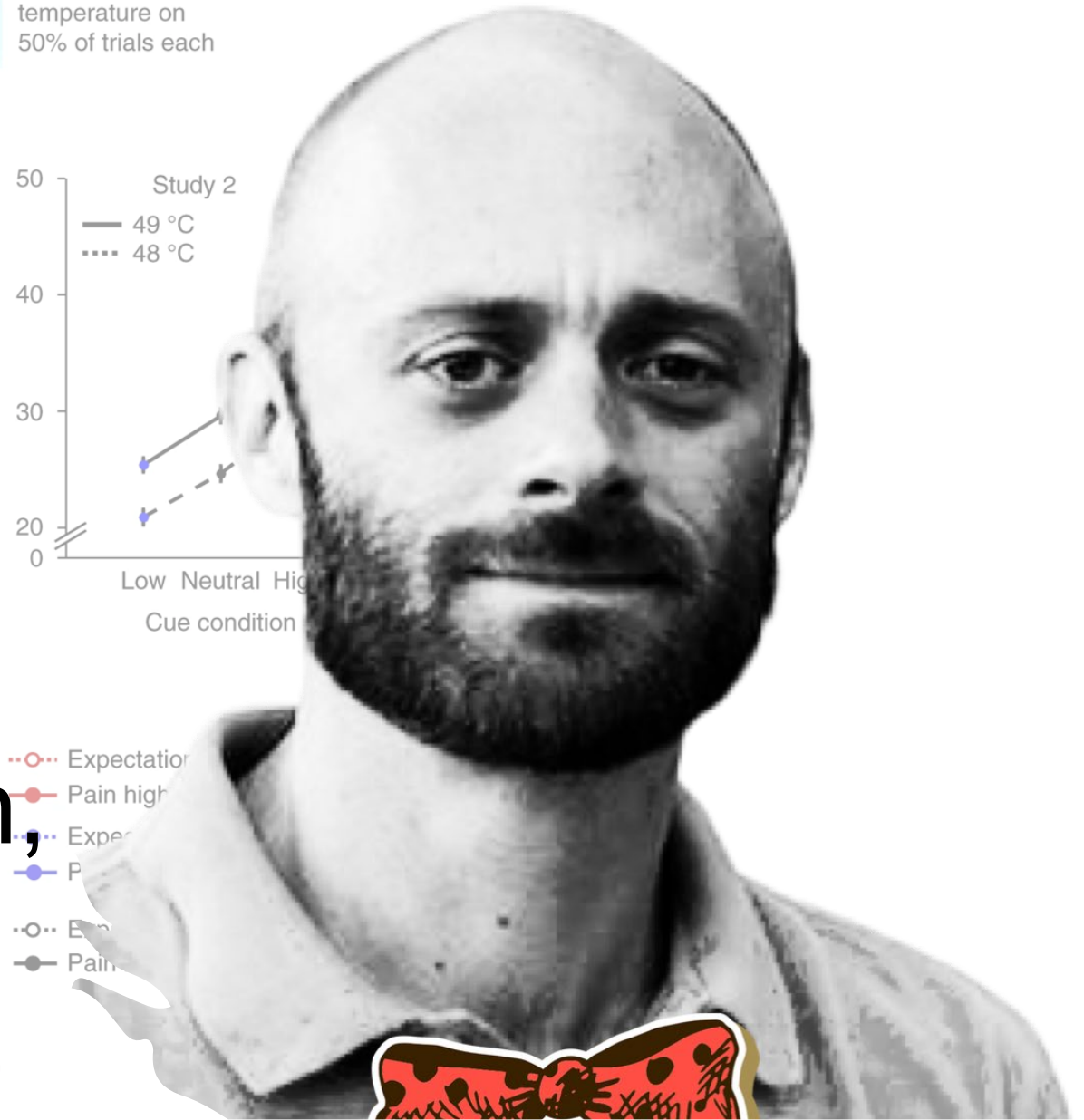
Jepma et al., 2018
Paskewitz, Stoddard, & Jones, 2022



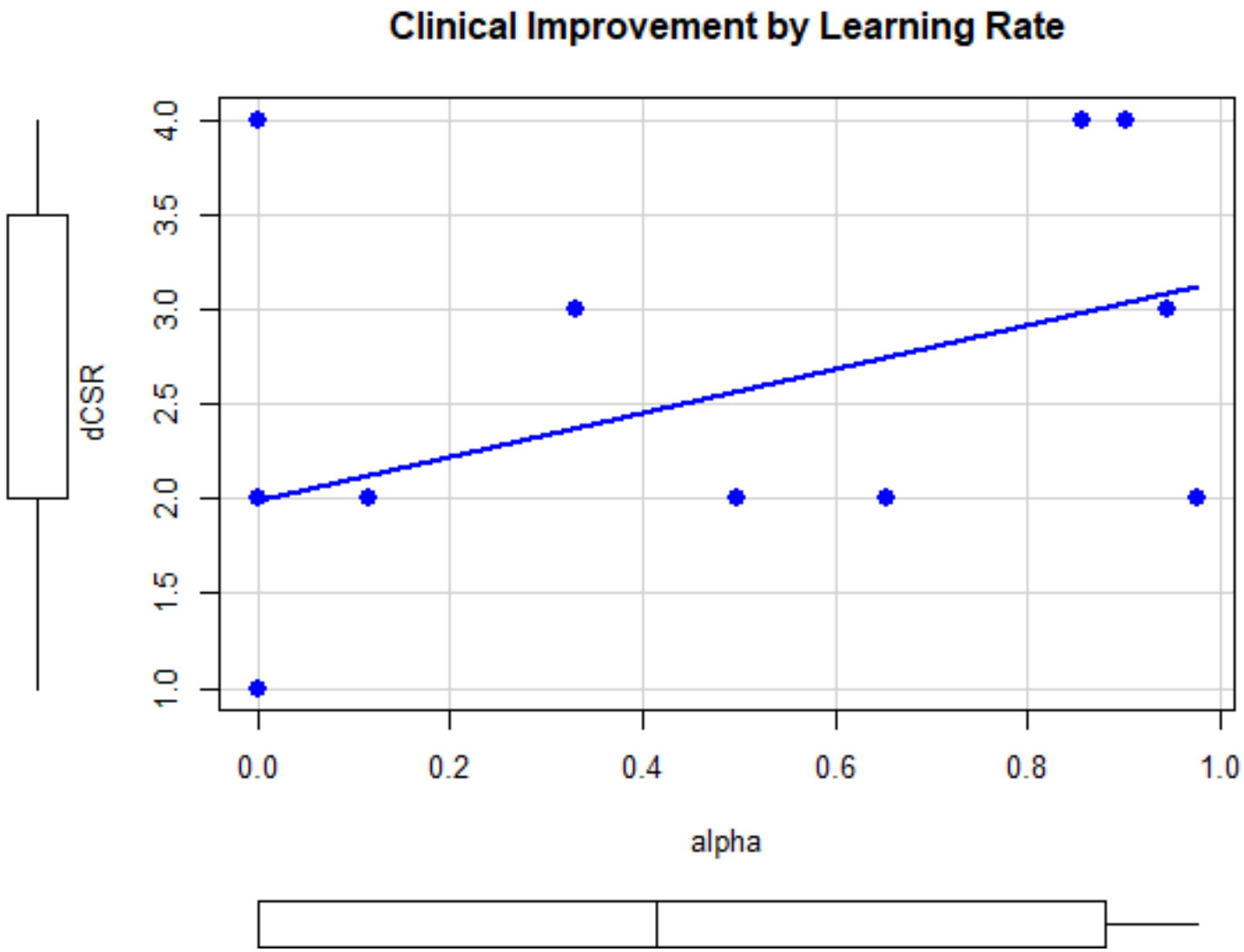




Jepma, Koban, van Doorn, Jones & Wager, *Nat Hum Behav* 2018



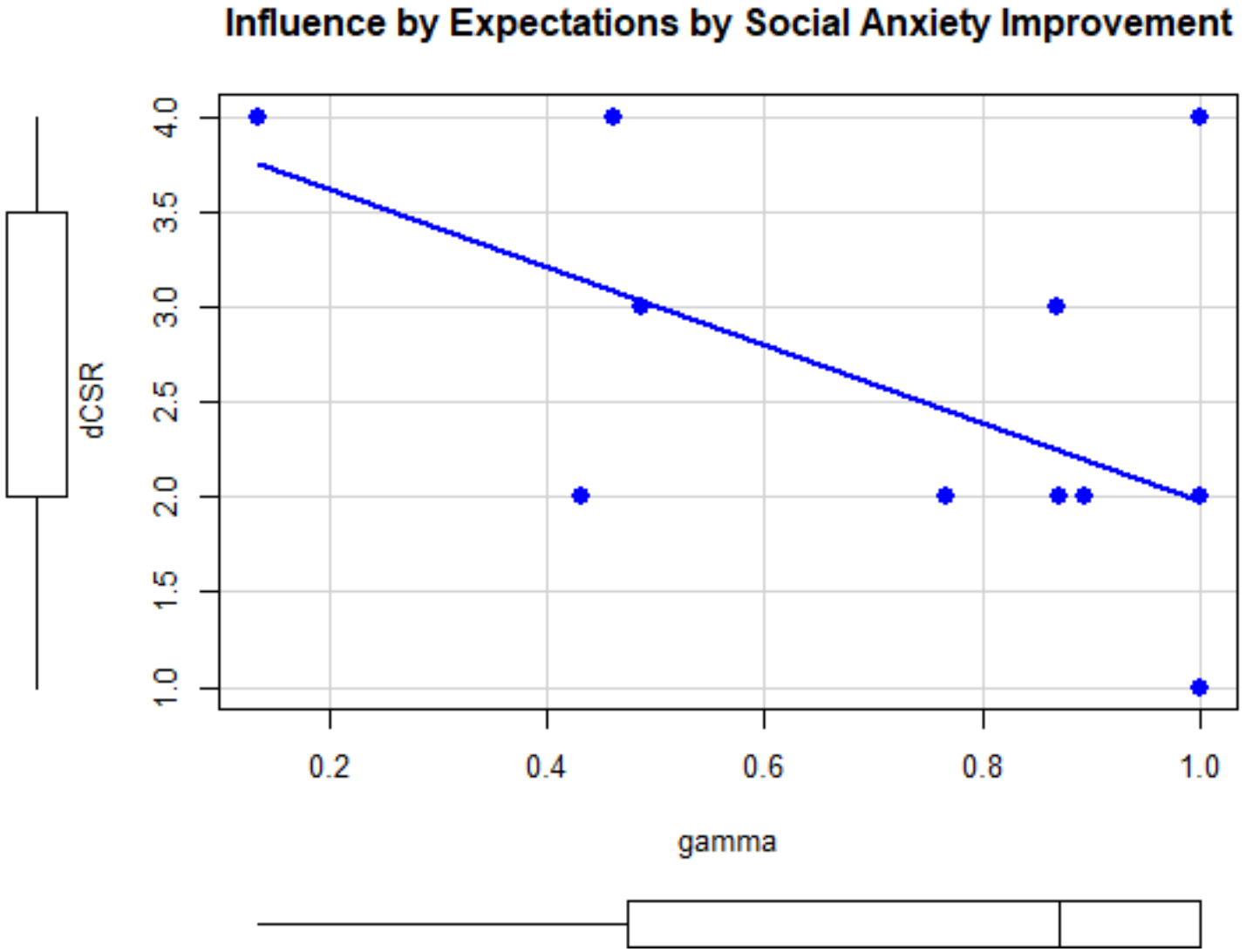
Change in clinical severity rating for social anxiety.
Greater numbers mean greater improvement.



Learning Rate During Exposure Therapy

r(10)=0.45, p=0.08 (one sided)

Change in clinical severity rating for social anxiety.
Greater numbers mean greater improvement.



Degree to which SUDS is influenced by that day's expectations.

r(10)=-0.55, p=0.03, one sided

ΨAI — Computational Cognitive Modeling

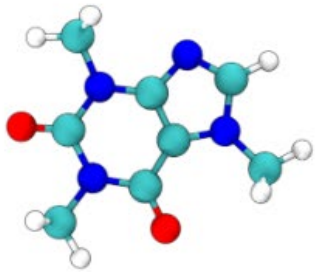
- Simulates or replicates neural function or cognitive processes
- Can teach us about function and processes
- Can be translated to measure these processes

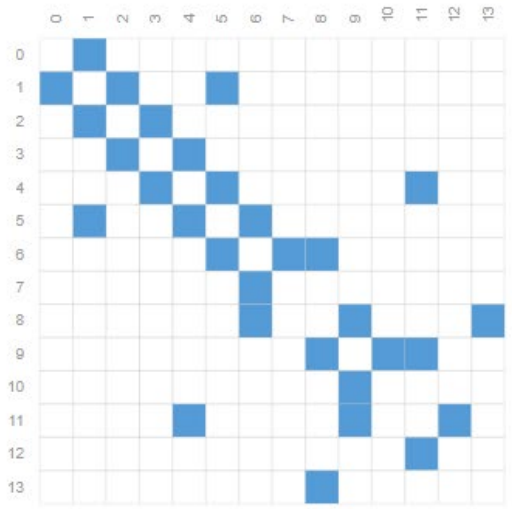
- In the DOP we've used these for
  - Emotional learning
  - Social function
  - Choice behavior
  - Motivation and substance use prediction

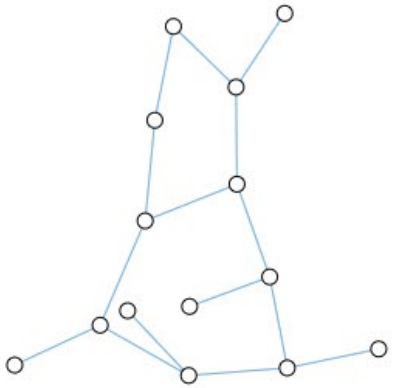
ΨAI

Precision Medicine

- Not necessarily biologically realistic
- Pattern detection and data reduction
- Can be translated to identify risks and predict outcomes



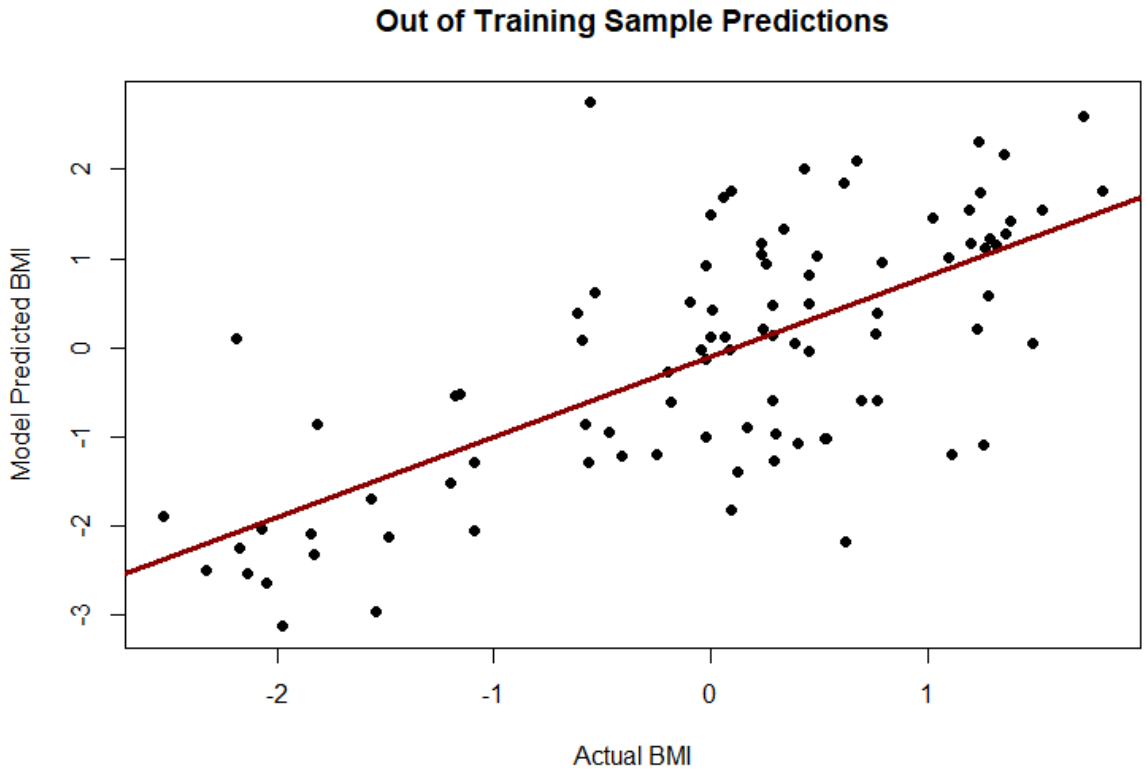




Graph representation of caffeine for graph neural network models. Sanchez-Lengeling 2021

Predicting Discharge BMI Adolescents with Anorexia, BMI<18.5

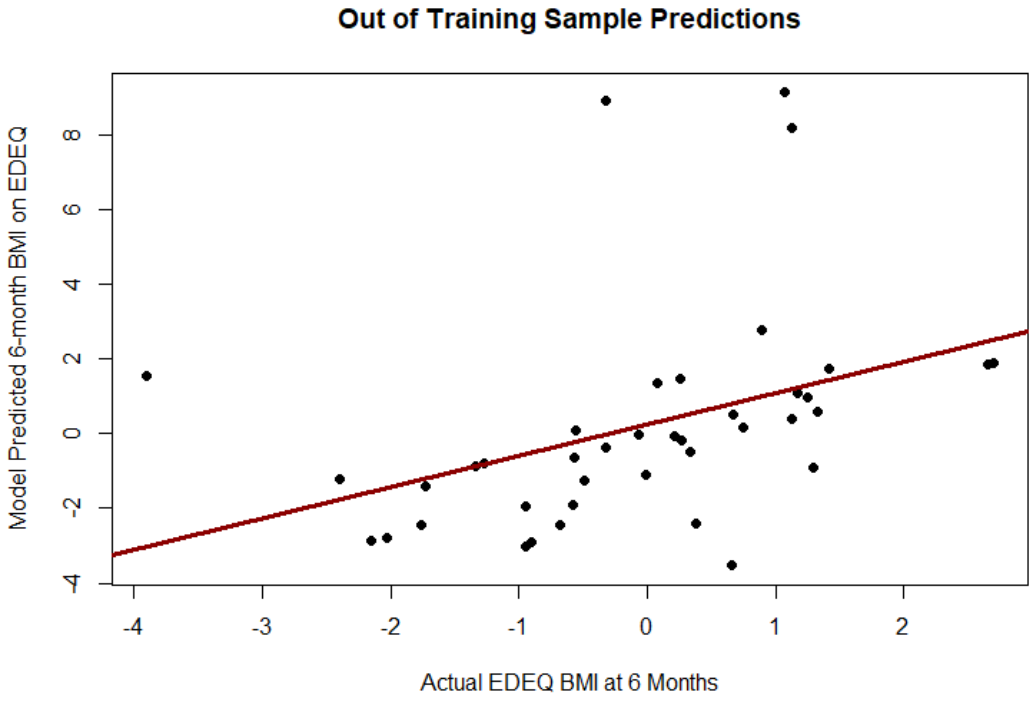
Total N=368,
train n=276, test n=92



	overall	rf	svmRadial	glmnet
LOS	25.96	38.78	29.69	0.40
reason_dcProper	13.46	11.90	0.00	28.76
Co_Psychotic1	6.09	0.07	0.00	22.16
reason_dcHLOC	5.49	2.49	0.00	15.80
reason_dc	3.52	0.00	13.72	0.00

- Ensemble model explains 51.2% variance in training set (N=276)
- Markedly predicts out of sample BMI (r=0.69, N=92, p=0)

Predicting Self Reported BMI 6 Months after Discharge
Adolescents with Anorexia, BMI<18.5
Total N=160,
train n=120, test n=40



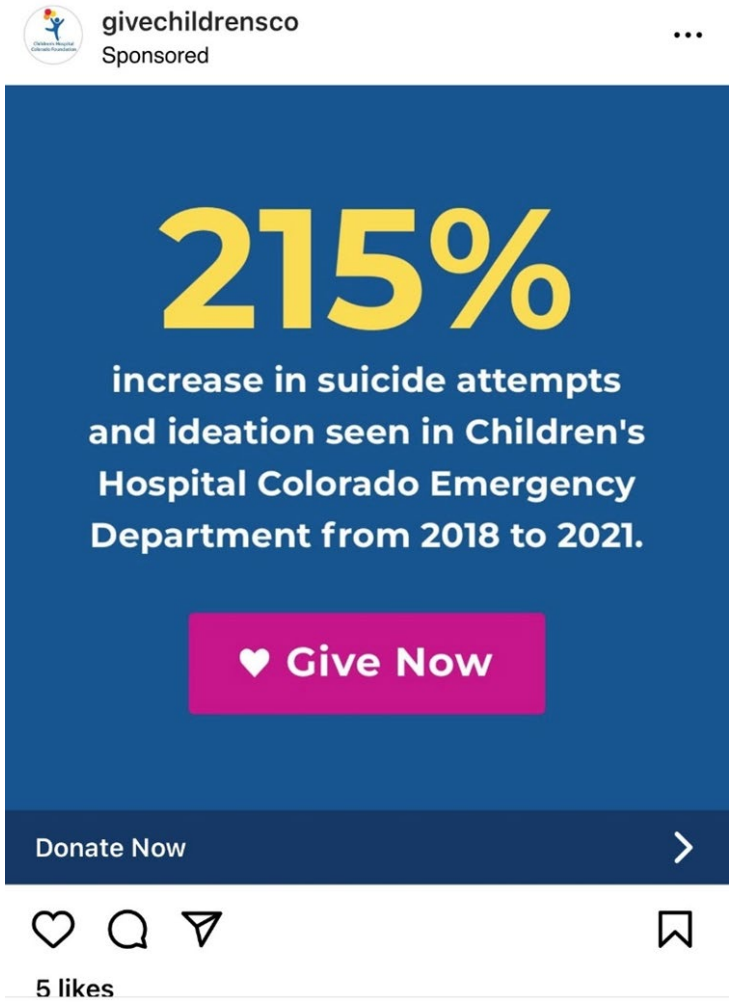
	overall	rf	svmRadial	glmnet
BMI_DCr	26.00	40.50	9.76	27.85
race_COMBINED 2	14.74	0.11	0.00	18.29
referral_srcNoTx	12.14	0.17	0.00	15.07
bisbas11	11.22	2.70	2.40	13.33
bisbas2	7.20	0.28	1.25	8.70
ders22	6.28	0.57	2.56	7.32
ders31	2.89	0.69	1.24	3.32

- Ensemble model explains 35.9% variance in training set (N=120)
- Solidly predicts out of sample BMI (r=0.39, N=40, p=0.01)

ΨAI — Precision Medicine

- Not necessarily biologically realistic
- Pattern detection and data reduction
- Can be translated to identify risks and predict outcomes

- At the DOP we've been using these for:
  - Decompensation prediction (HealthRhythms)
  - Treatment response for eating disorders
  - Outburst prediction in ASD (Romani)
  - Suicidality prediction in adolescence (CereHealth)
  - Mood episode emergence in adolescence (CereHealth)
  - Substance use emergence throughout the lifespan

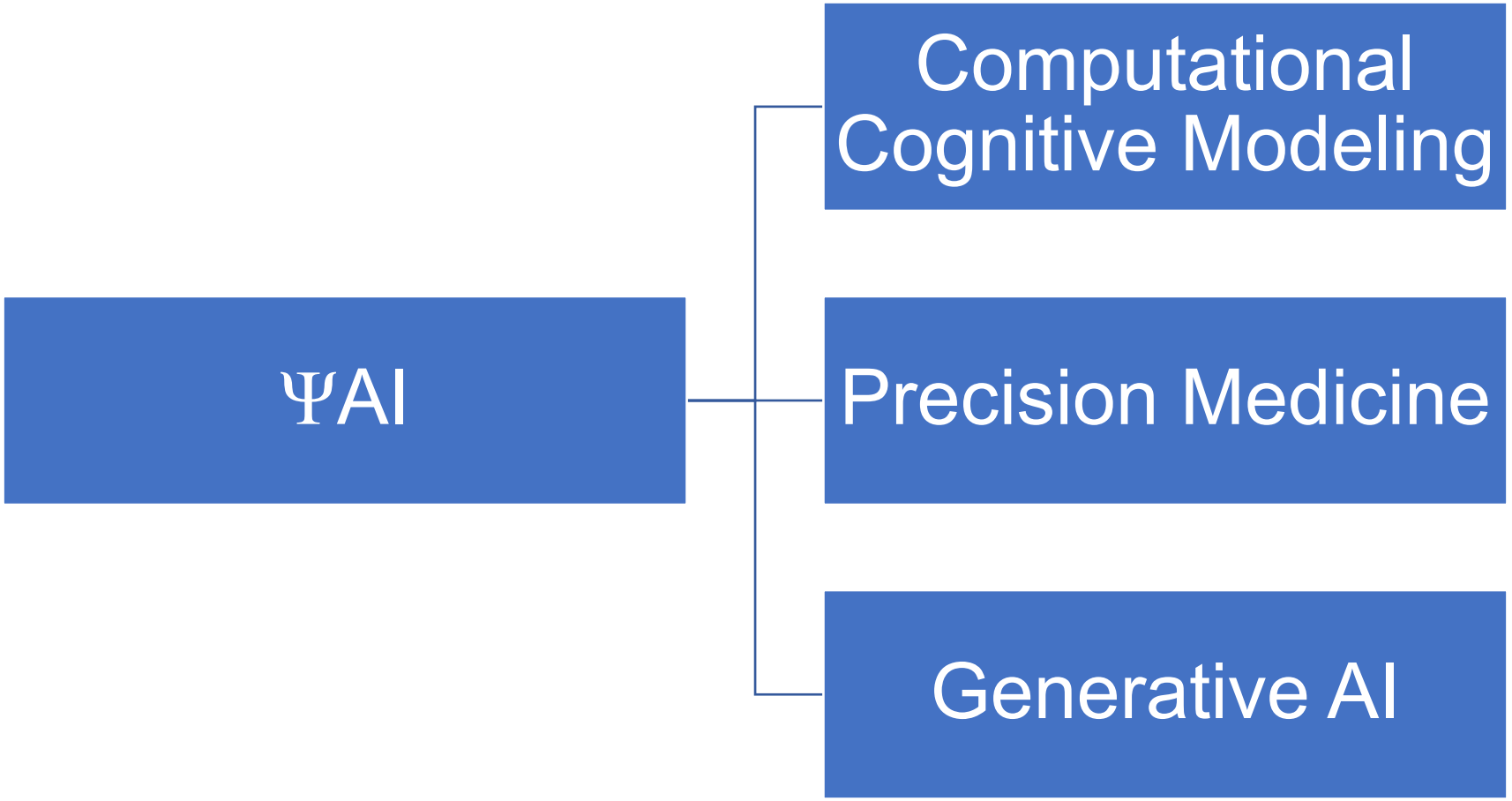


ΨAI — Generative Models

- Outputs most probable response based on learned data
- Synthesize a large body of data to output context dependent answers

- In the DOP, truly generative AI work is pending; though rules-based algorithms mimicking generative AI are being explored!

Therapist kitty,
Source: Bing Image Creator/DALL-E



Stoddard & Jones, 2019